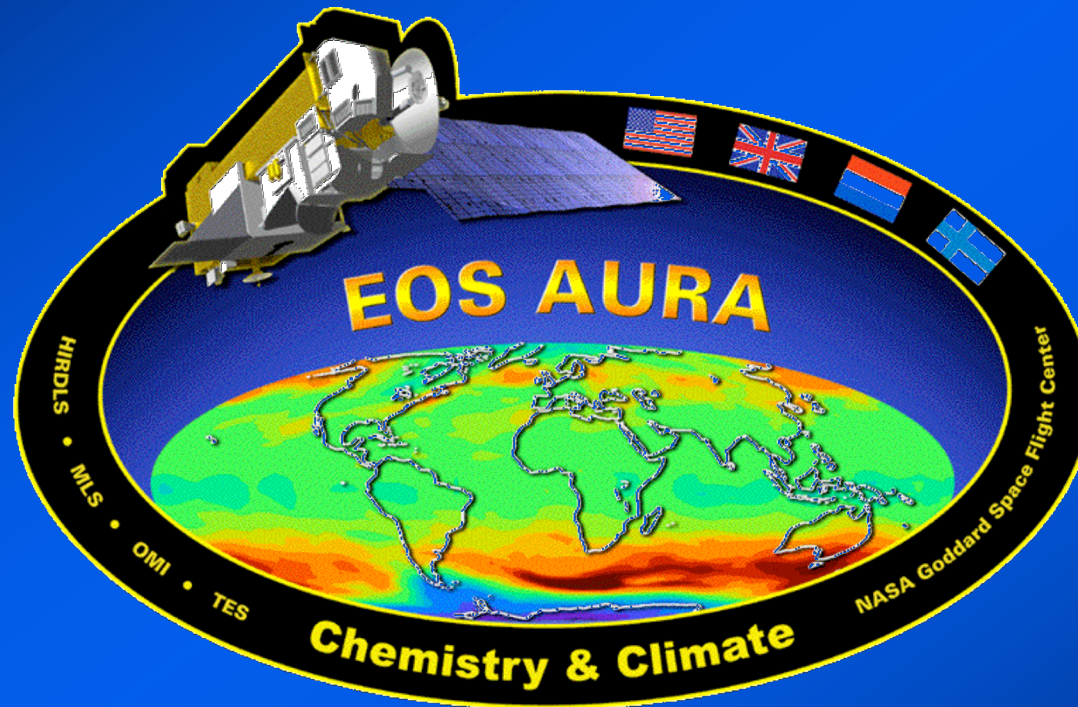


Results from the EOS Aura Mission



Anne Douglass
NASA/GSFC



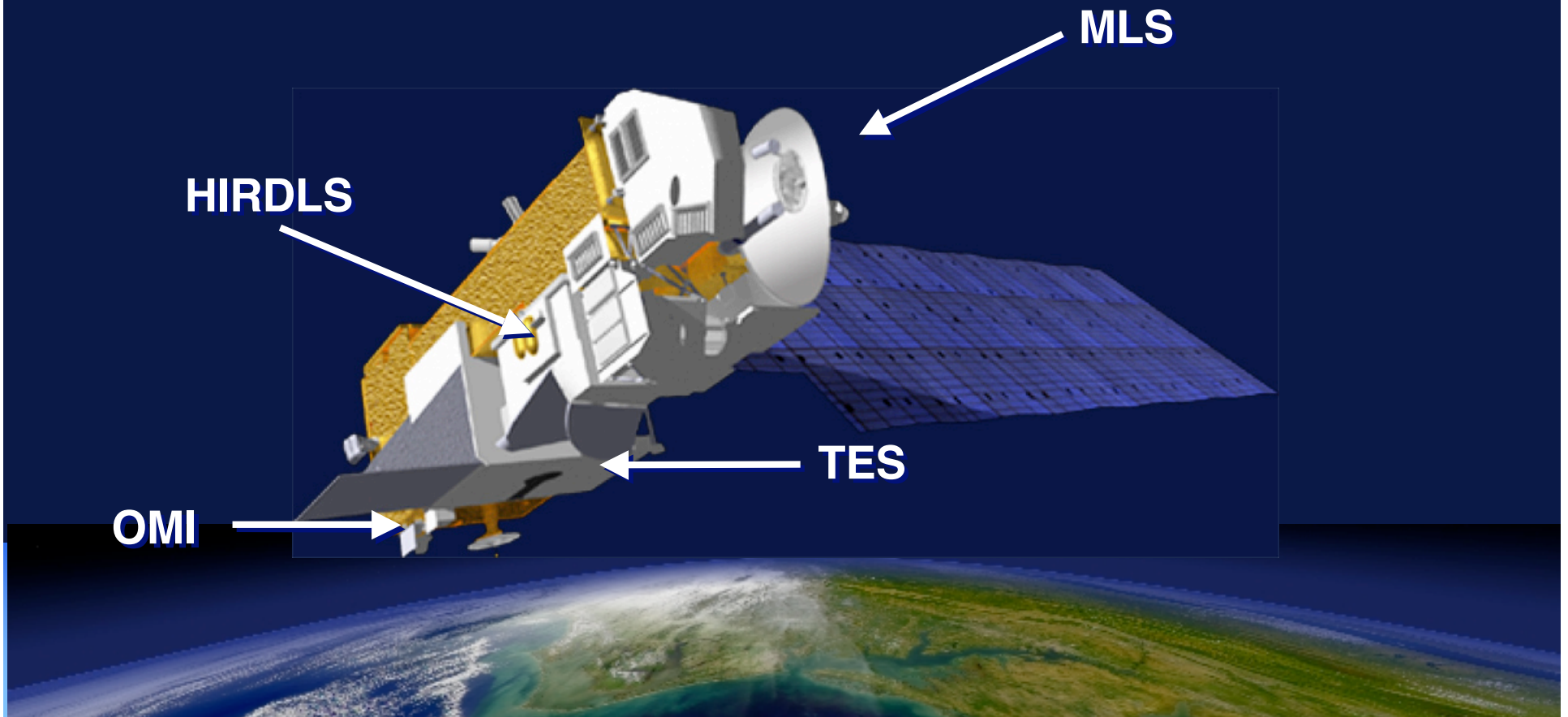
Outline

- **Aura Status**
- **Early Results**
 - HIRDLS
 - MLS
 - TES
 - OMI
- **Validation activities**
 - AVE
 - PAVE
 - Satellite Intercomparisons



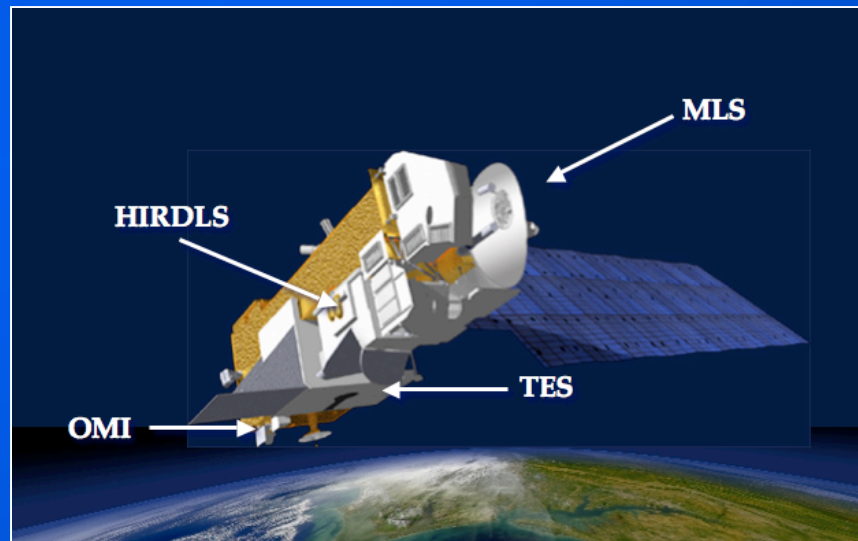
EOS AURA

- Orbit: Polar: 705 km, sun-synchronous, 98° inclination, ascending 1:45 PM +/- 15 min. equator crossing time.
- Launch Vehicle: Delta 7920 from VAFB, July 15, 2004
- AURA will follow AQUA in the same orbit by 15 minutes.
- Six Year Spacecraft Life



Aura Operational Status

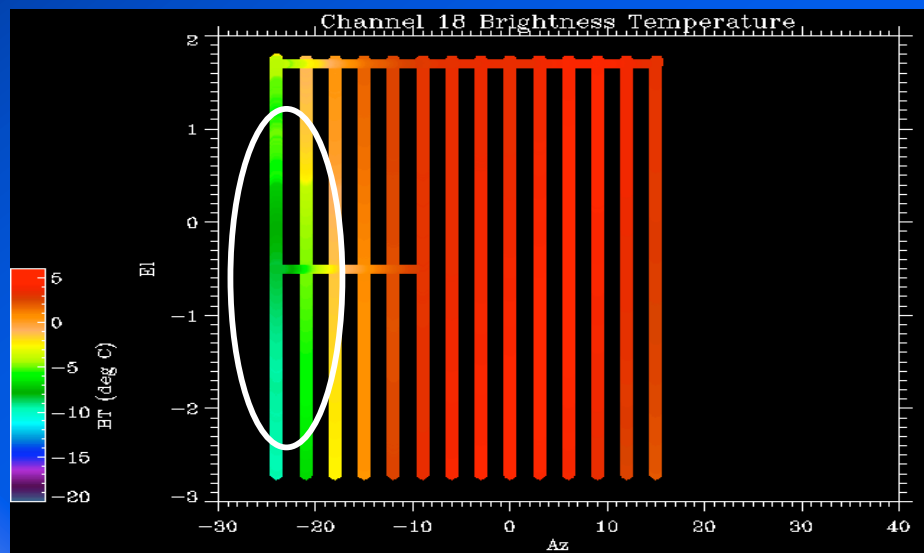
- **MLS** - Operating nominally
- **OMI** - Operating nominally
- **TES** - Increasing sign of bearing wear has caused interruptions of operations. TES will no longer doing limb mode to preserve lifetime. TES is currently off until the end of June to investigate bearing problems.
- **HIRDLS** - A piece of kapton apparently blocks most of the optical path. HIRDLS is operating using the remaining opening. HIRDLS should retrieve profiles at a single azimuth



HIRDLS

HIRDLS can still operate at the edge of the scan position.
The HIRDLS Team is working to modify their algorithms to work around this problem.

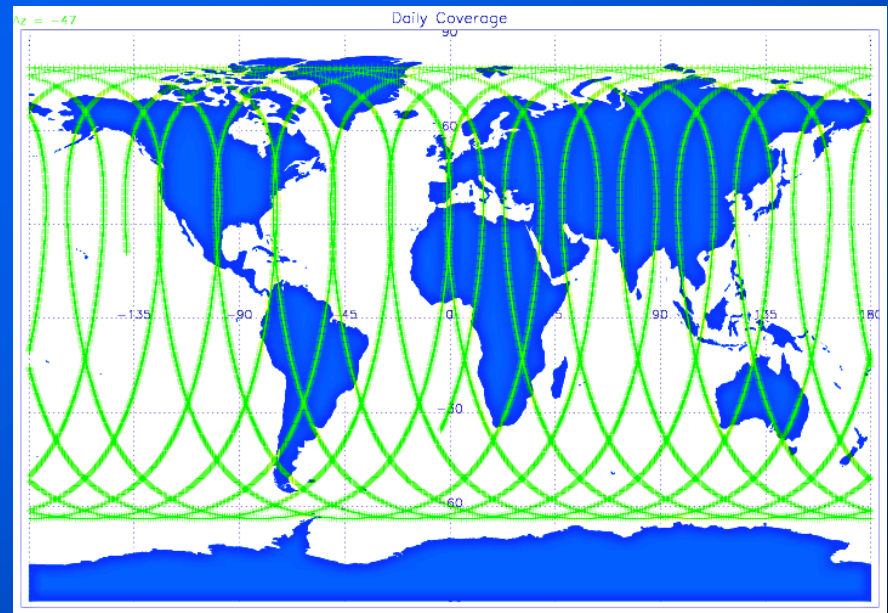
Radiometric scans of the aperture



Clear

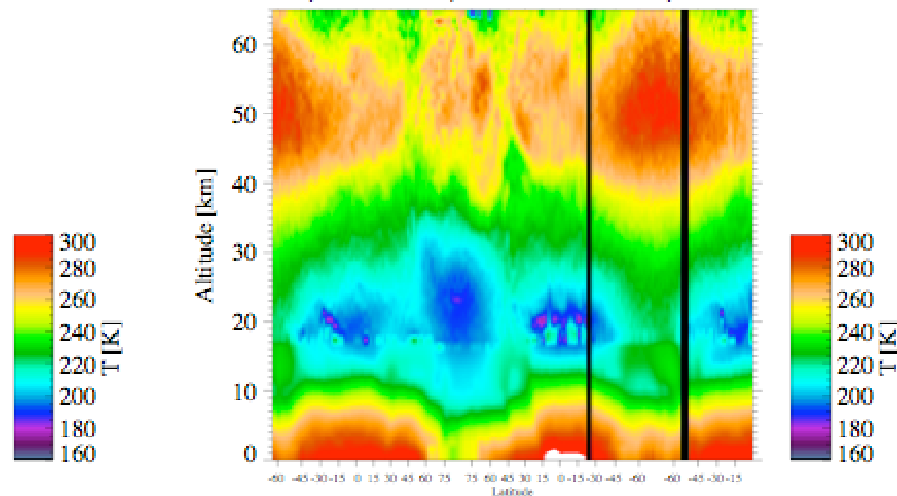
Blocked

Revised Instrument Coverage

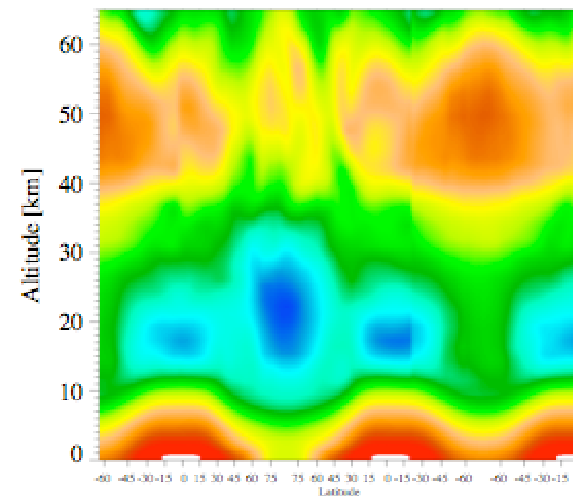


HIRDLS T

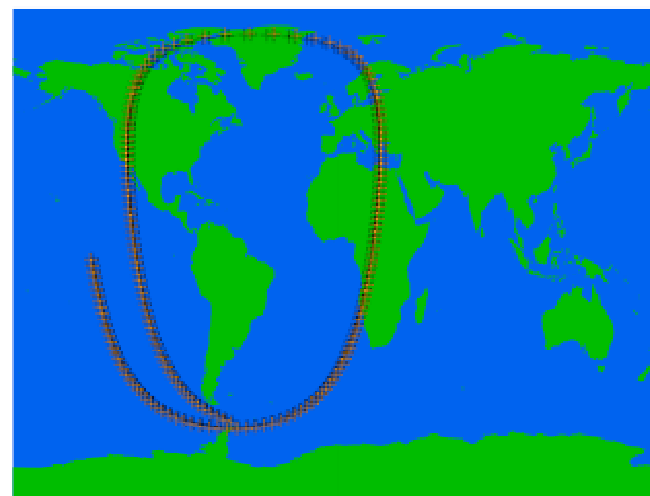
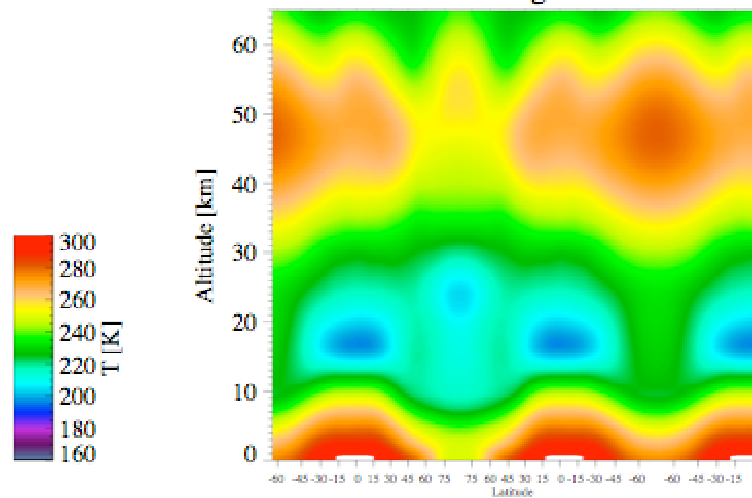
Retrieved T; 2005d021, rs5c3d021decon, PATH0abcv12



MLS T

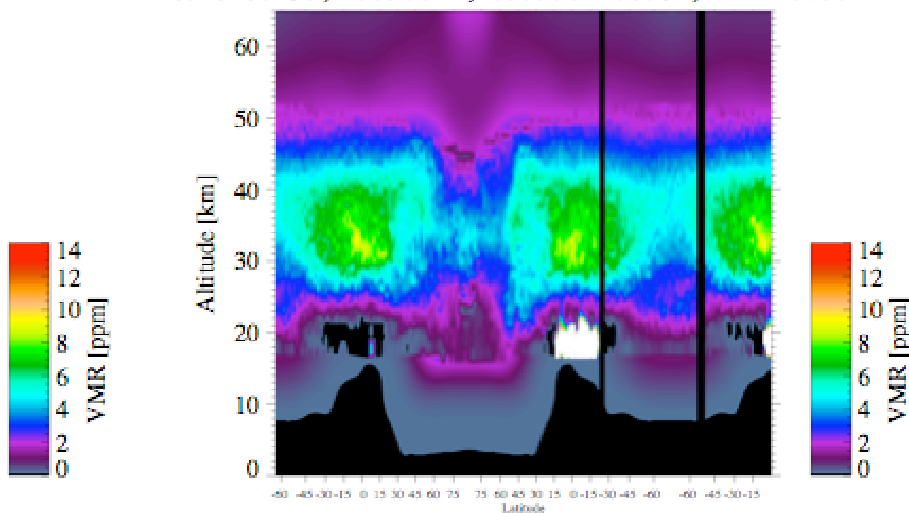


Climatological T

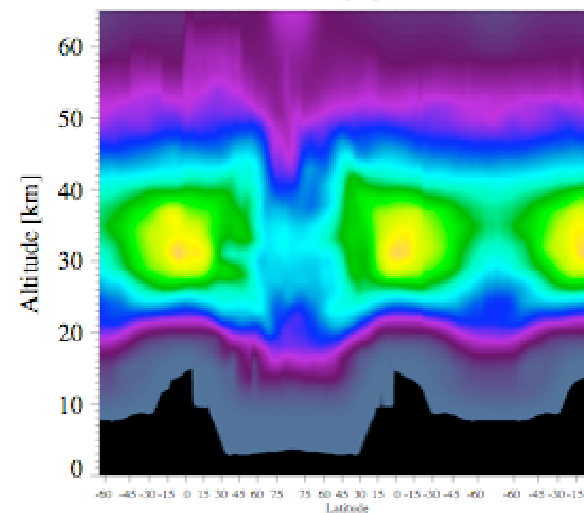


HIRDLS O3

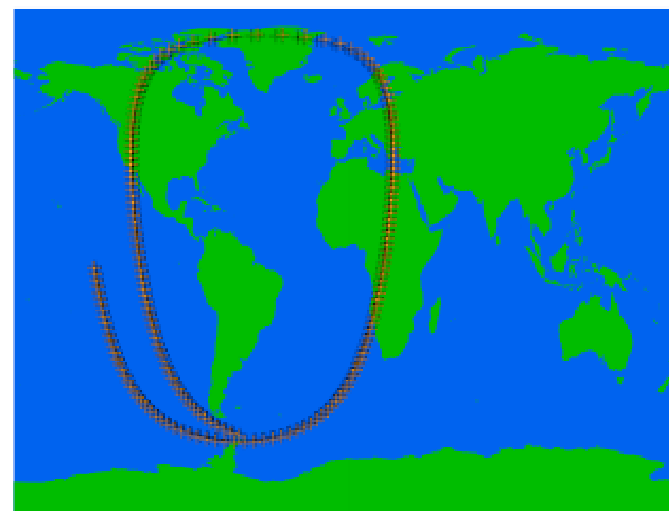
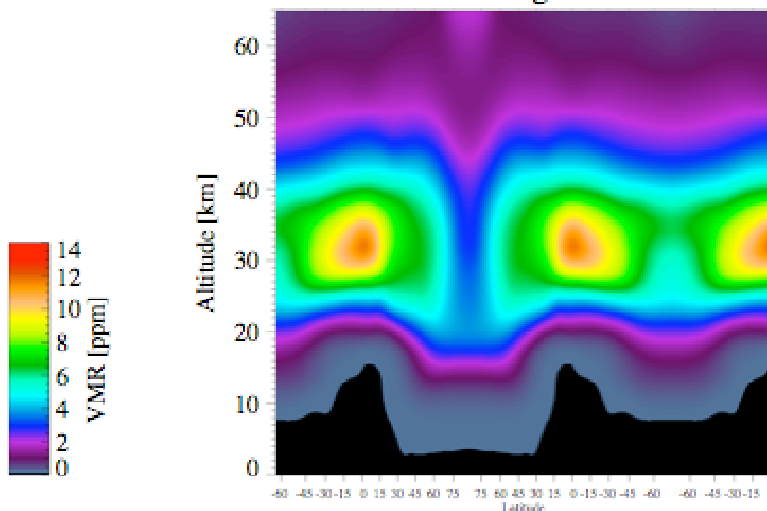
Retrieved O3; 2005d021, rs5c3d021decon, PATH0abcv12



MLS O3



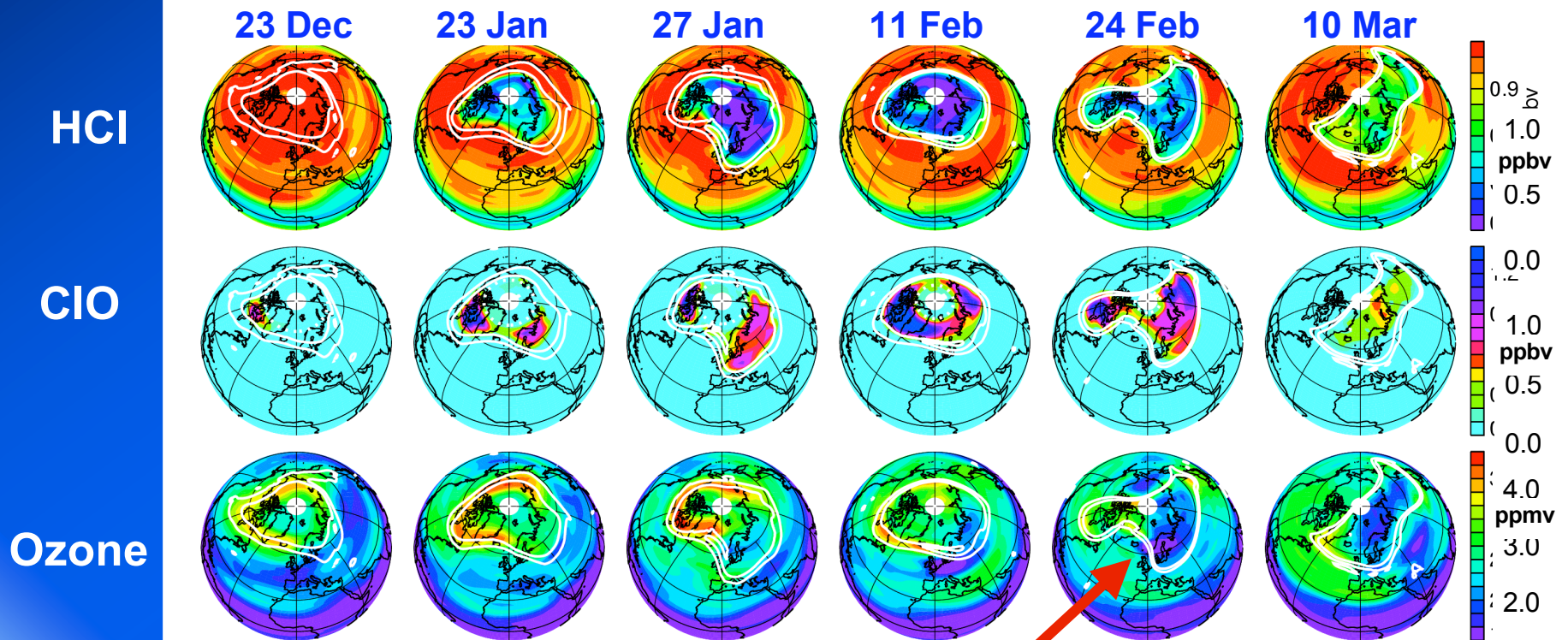
Climatological O3



MLS Destruction of Arctic Ozone this Winter

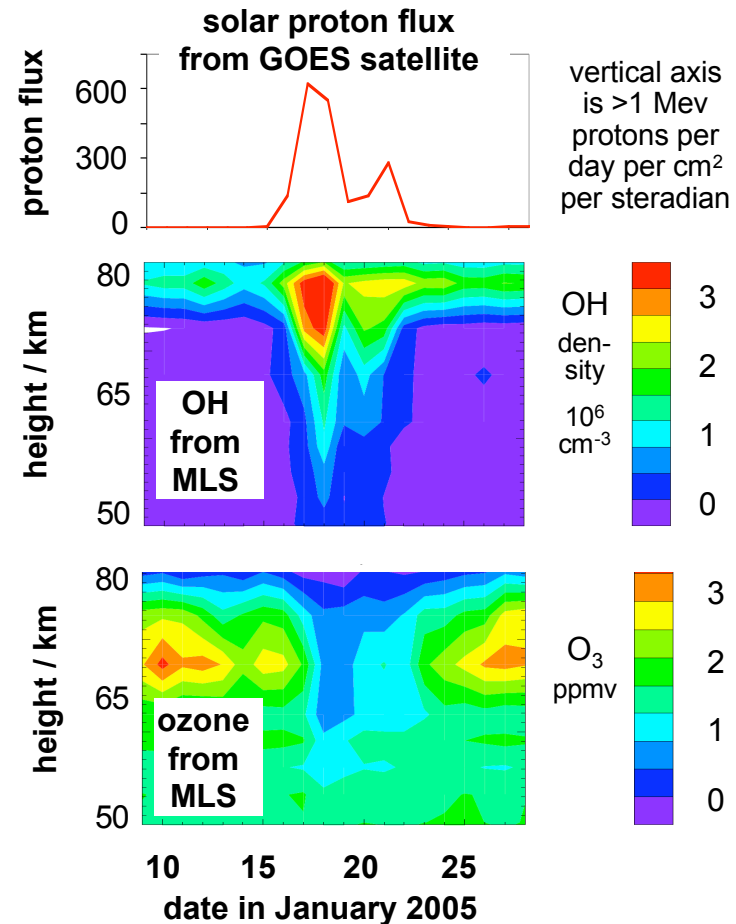
- Aura's MLS has quantified ozone destruction in the 2004-2005 Arctic winter
 - The destruction this winter reached a level seen only once before in the Arctic
- Transport processes compensated for the destruction to an unusual degree this winter, resulting in near-average Arctic ozone amounts in spring

MLS maps at 18 km height for selected days in 2004-2005

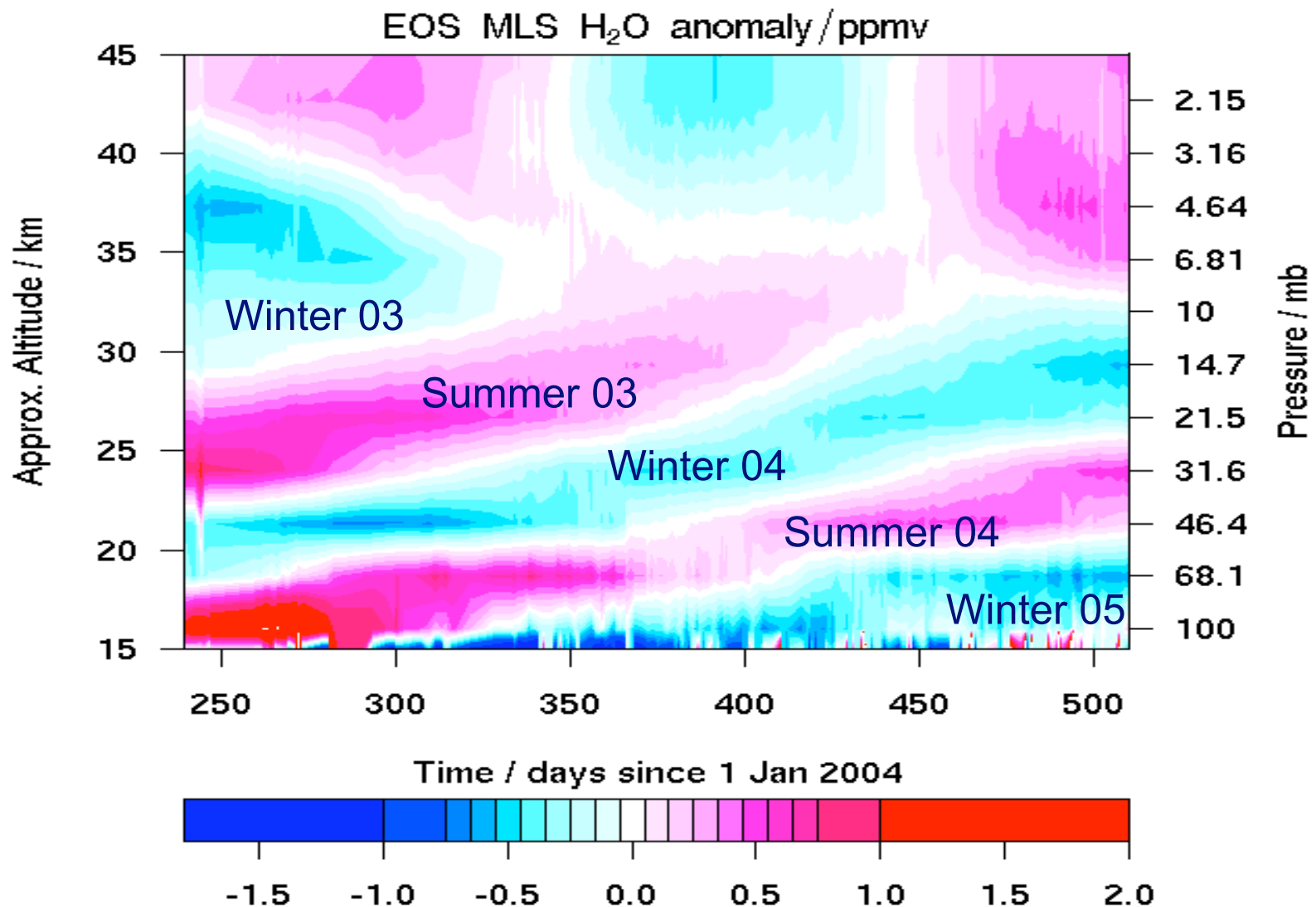


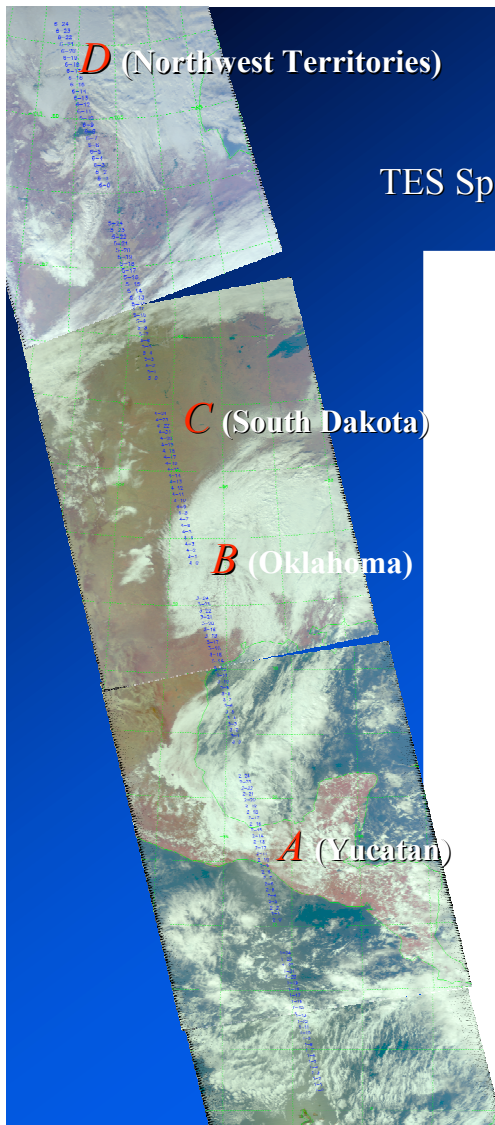
Solar Flare Affecting Mesospheric OH and Ozone

- MLS has provided the first observation of a solar proton flare enhancing mesospheric OH and its resulting destruction of mesospheric ozone
- Images at right show solar proton flux from mid-Jan 2005 solar flare and its resulting effects on Arctic OH and ozone
 - Earth's magnetic field 'funnels' protons into polar regions where this effect is observed, most prominently in the Arctic night shown here
 - Expected related effects have been detected by MLS in the Antarctic and in mesospheric HO_2



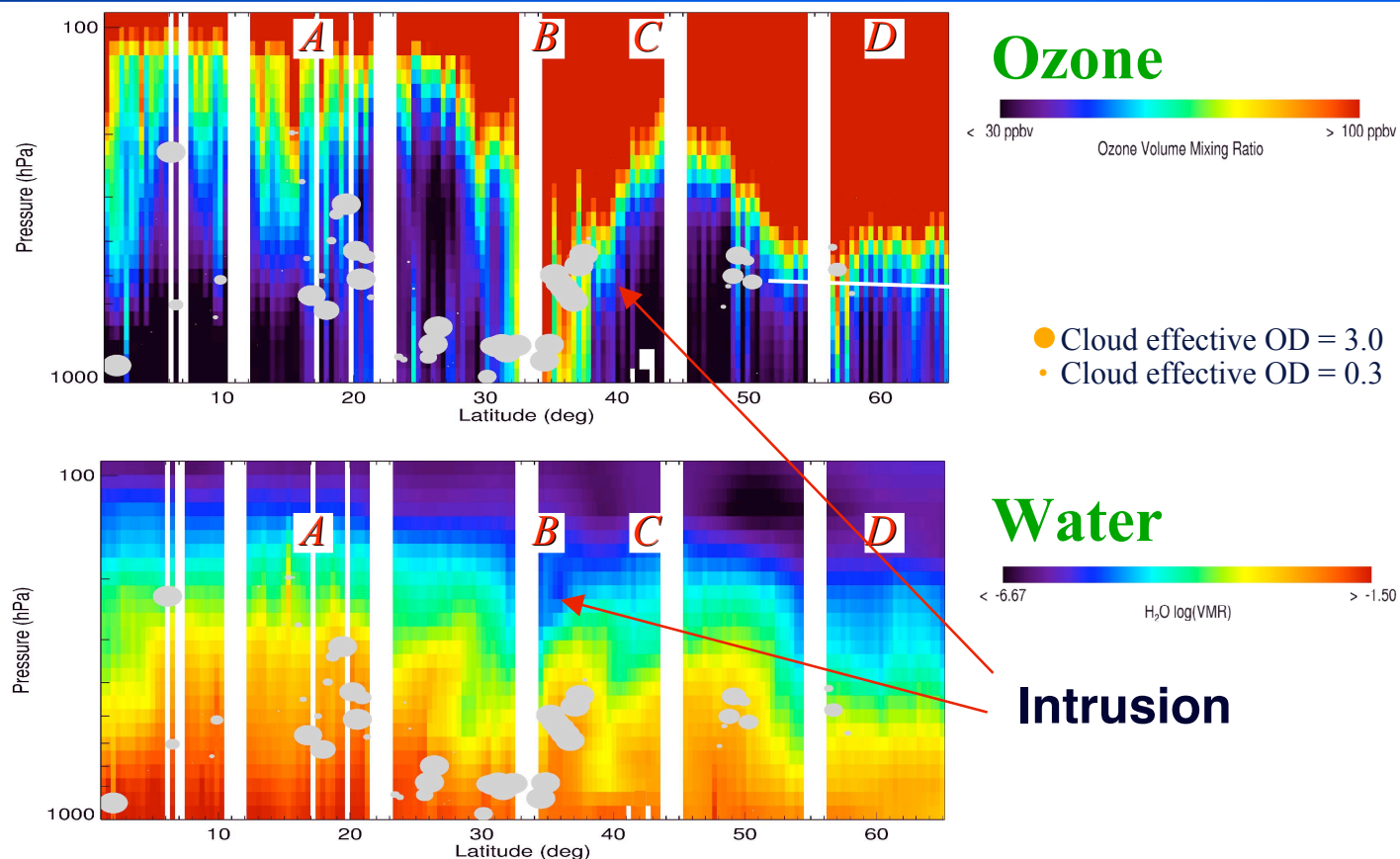
MLS Water Vapor Tape Recorder





TES Retrieval through Clouds

TES Special Observation: Nadir Step & Stare for Nov 3, 2004 (150 observations from 1N to 65N)



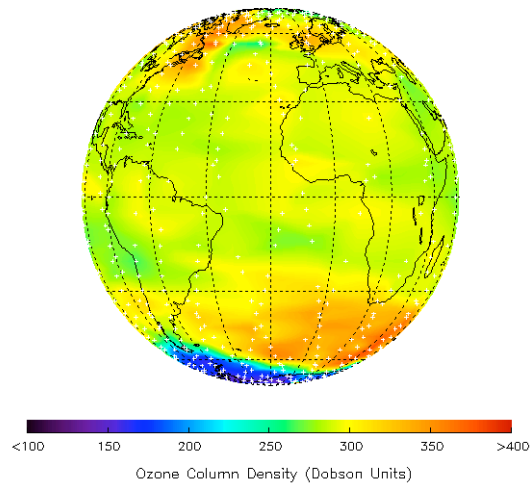
The TES retrievals for ozone and water with the TES retrieved cloud effective optical depth and height shown with gray circles. The ozone and water retrievals both indicate a stratospheric intrusion around 35°N (near B), and show TES's capability to retrieve through thin clouds and above thick clouds.



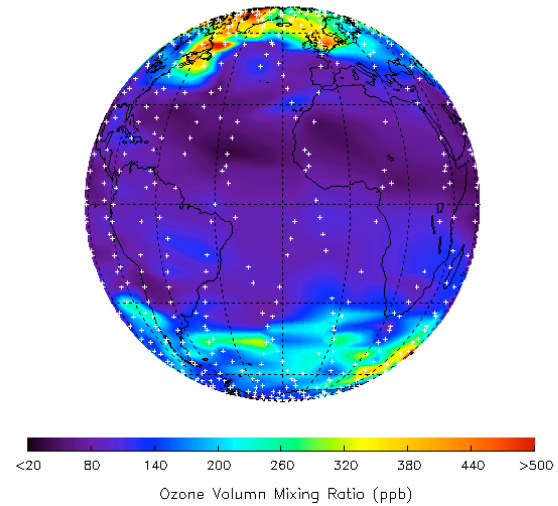
Sept. 20-21, 2004

TES Ozone

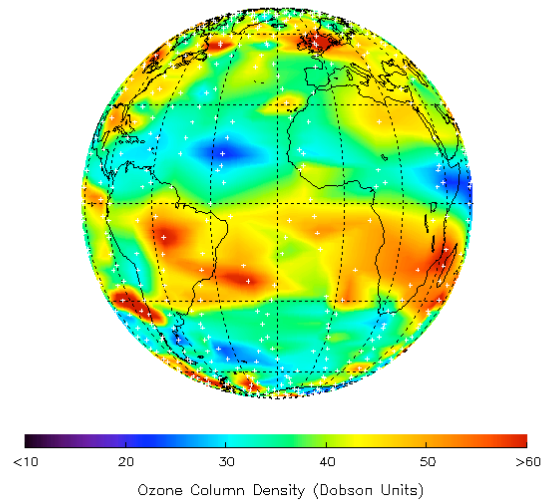
Total O3 Column



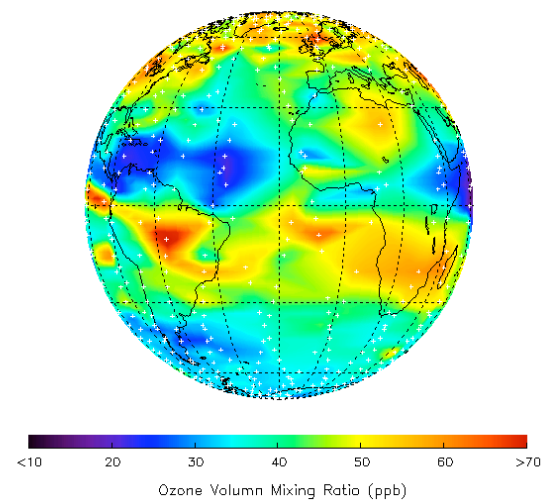
Tropospheric O3 215 mb



Tropospheric O3 Column



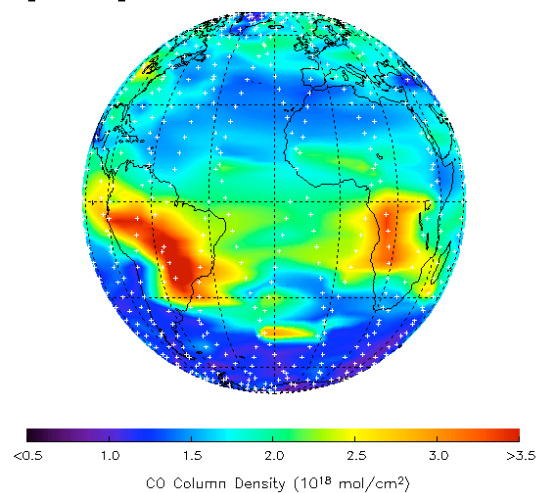
Tropospheric O3 618 mb



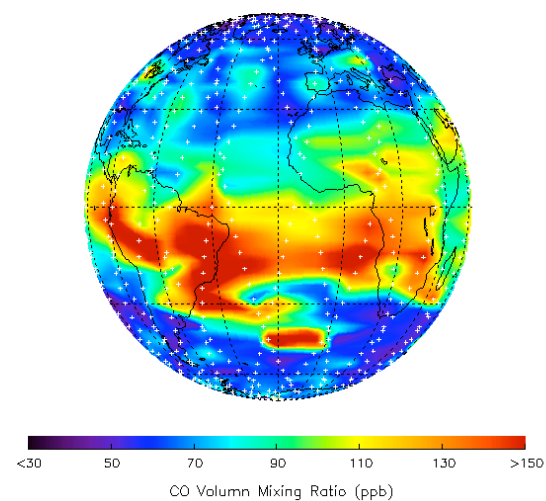
Sept. 20-21, 2004

TES CO

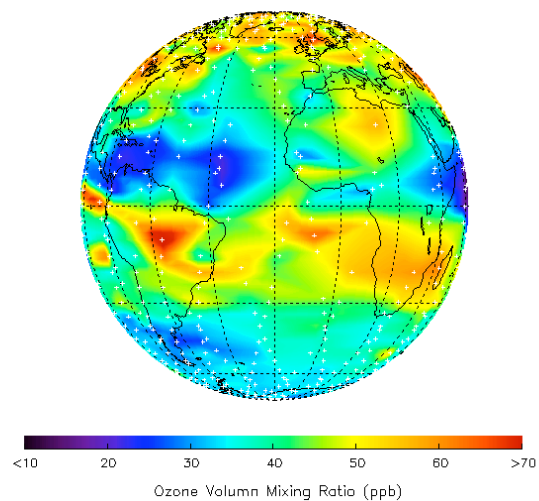
Tropospheric CO Column



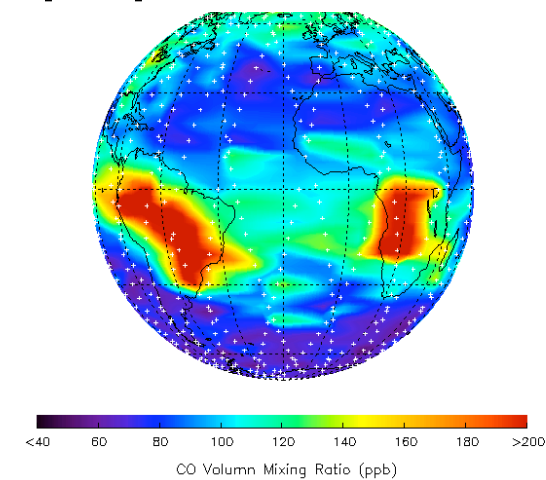
Tropospheric CO 215 mb



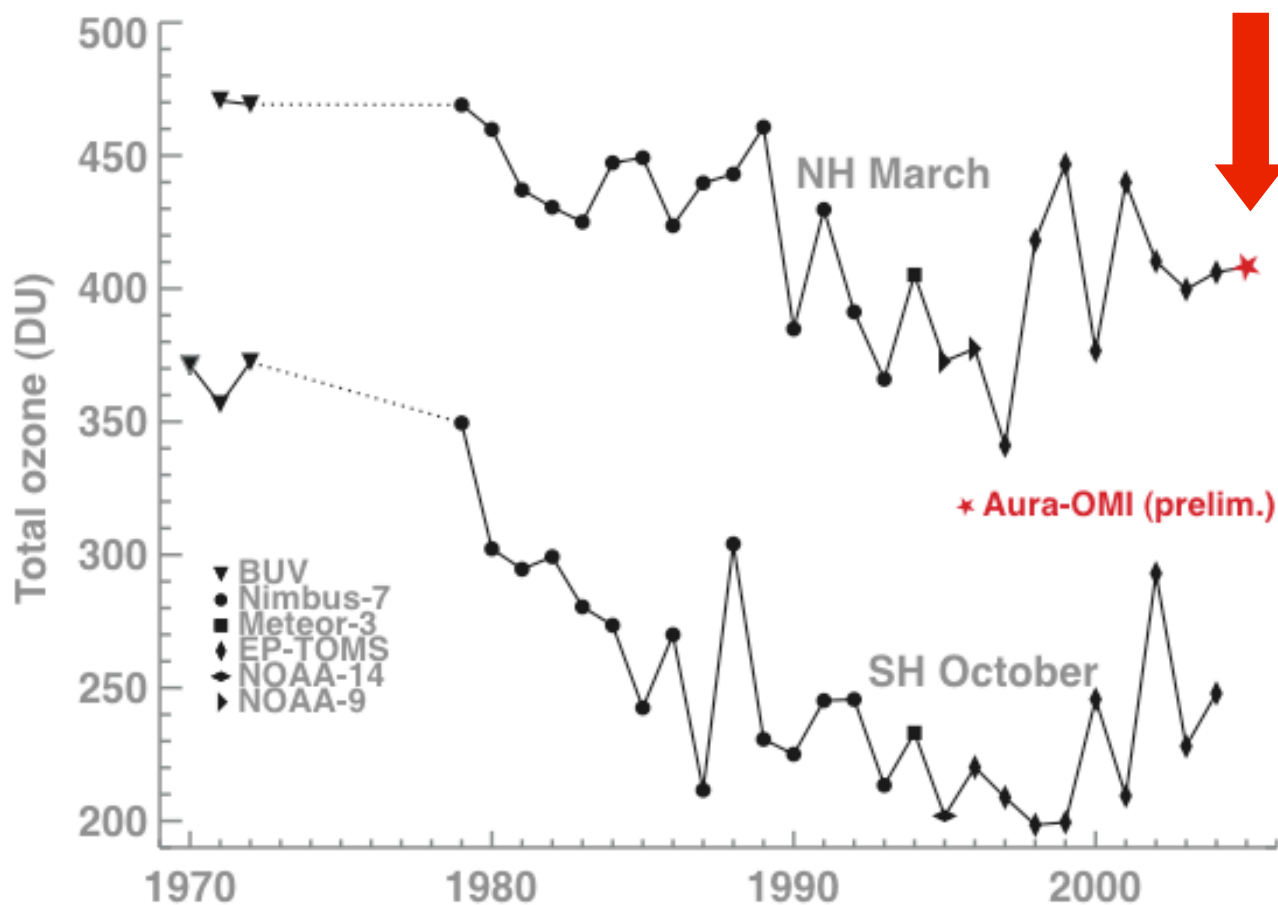
Tropospheric O3 618 mb



Tropospheric CO 618 mb



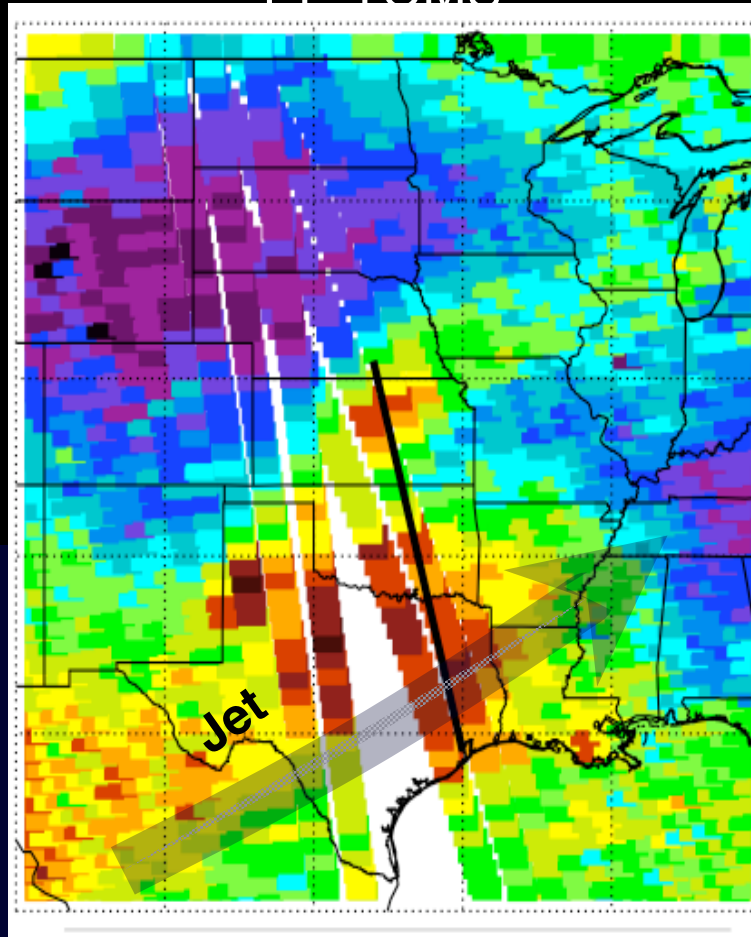
OMI Extends the Ozone Record



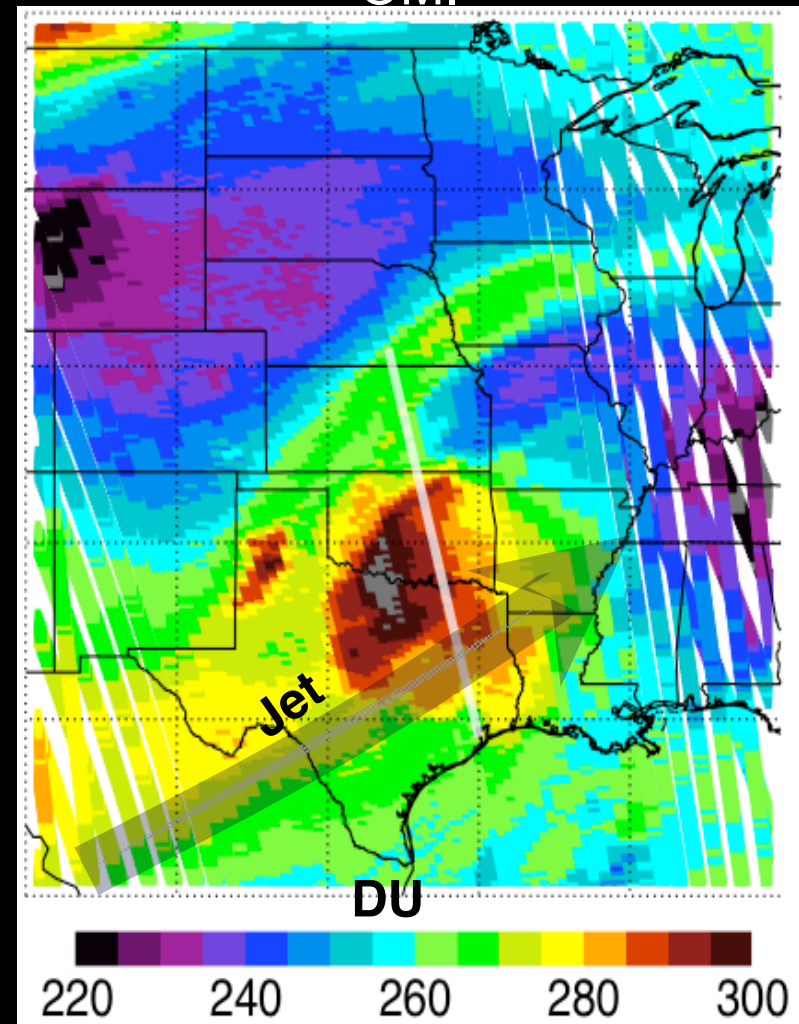
AVE '04

11/3/2004 Flight Track Tropopause Fold

EP TOMS



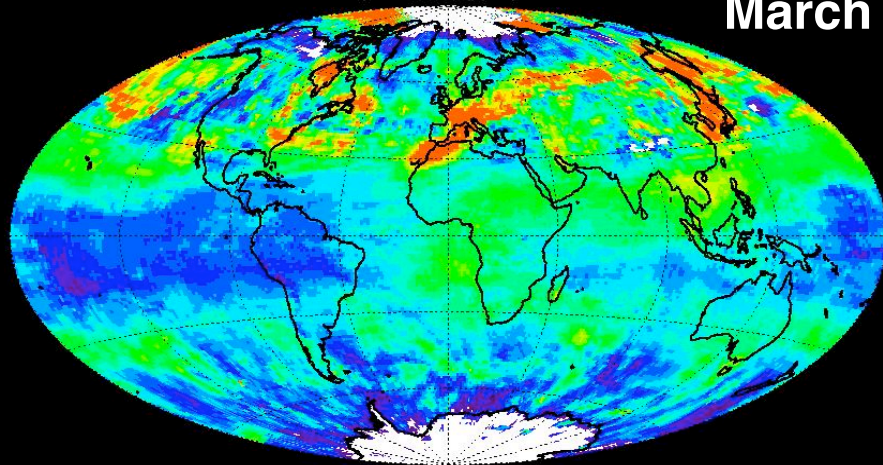
OMI



Aura OMI/MLS Tropospheric Ozone Volume Mixing Ratio March 2005

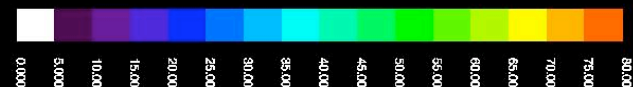
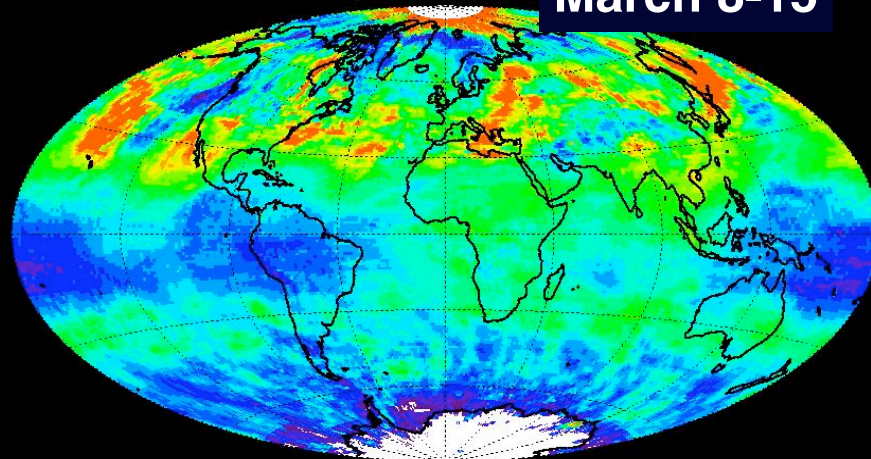
Aura OMI/MLS Tropo O3 VMR (ppbv) 1-7 March 2005

March 1-7



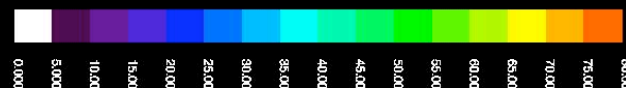
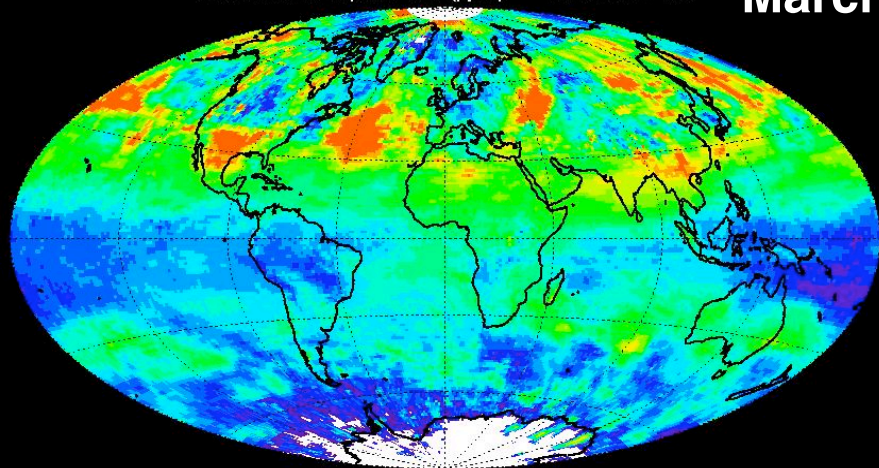
Aura OMI/MLS Tropo O3 VMR (ppbv)

March 8-15



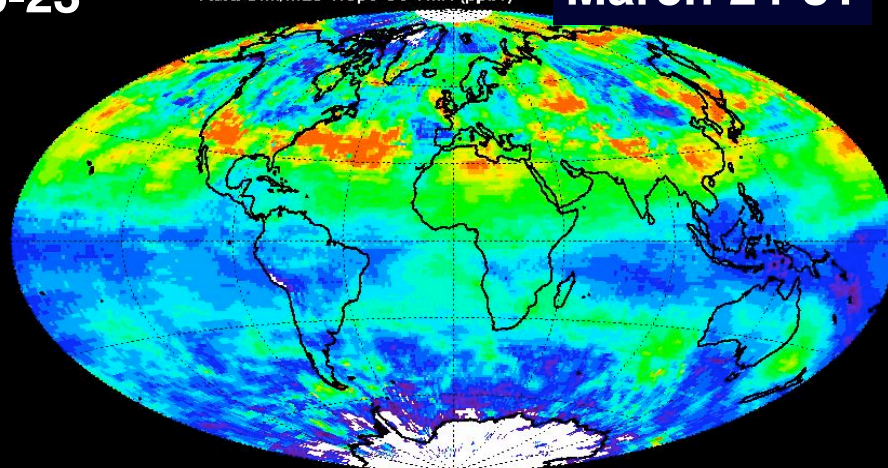
Aura OMI/MLS Tropo O3 VMR (ppbv) 16-23 March 2005

March 16-23



Aura OMI/MLS Tropo O3 VMR (ppbv)

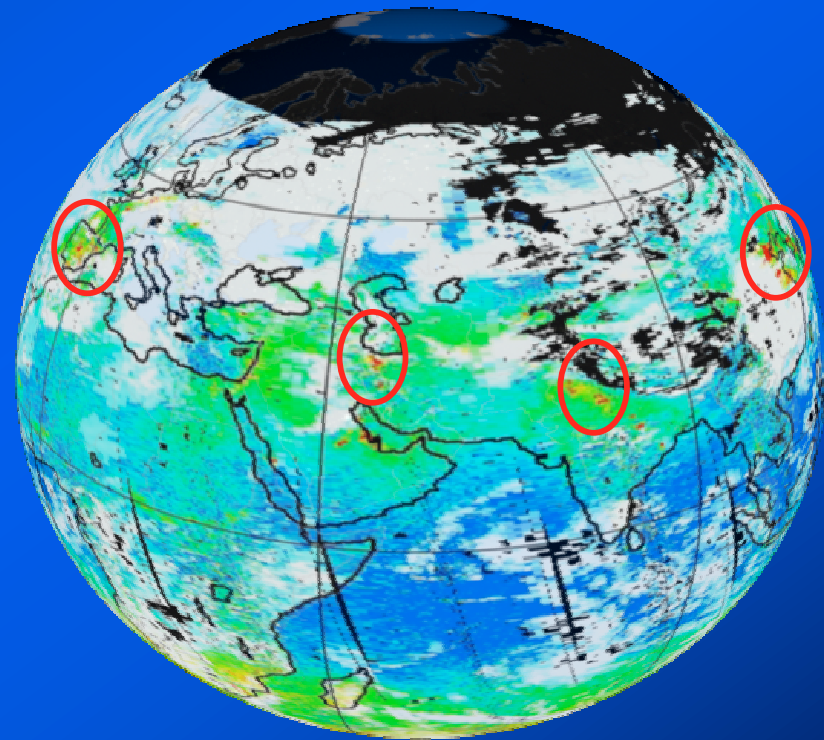
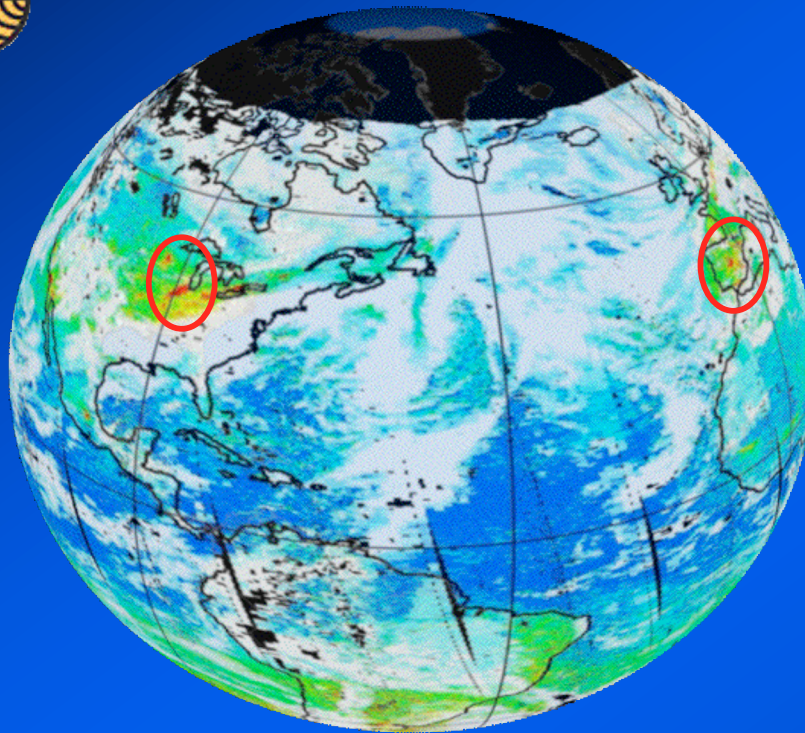
March 24-31



OMI Troposphere NO₂



November 12, 2004

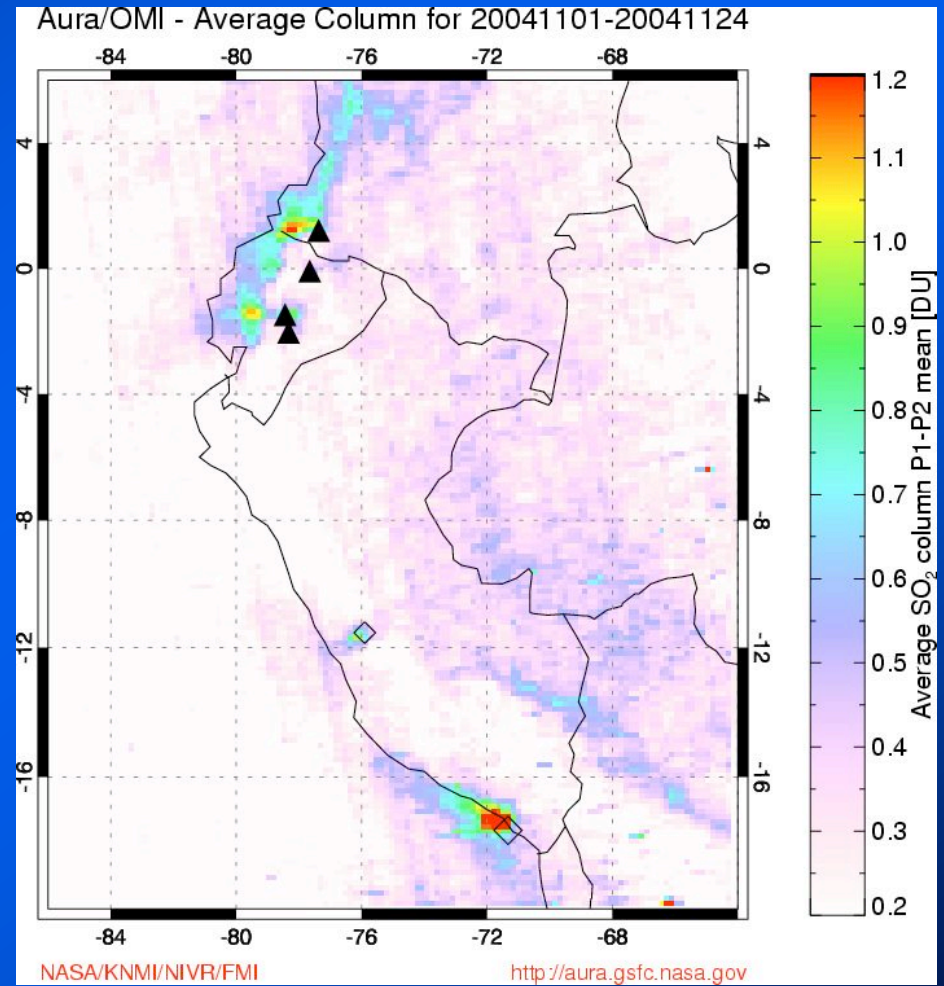
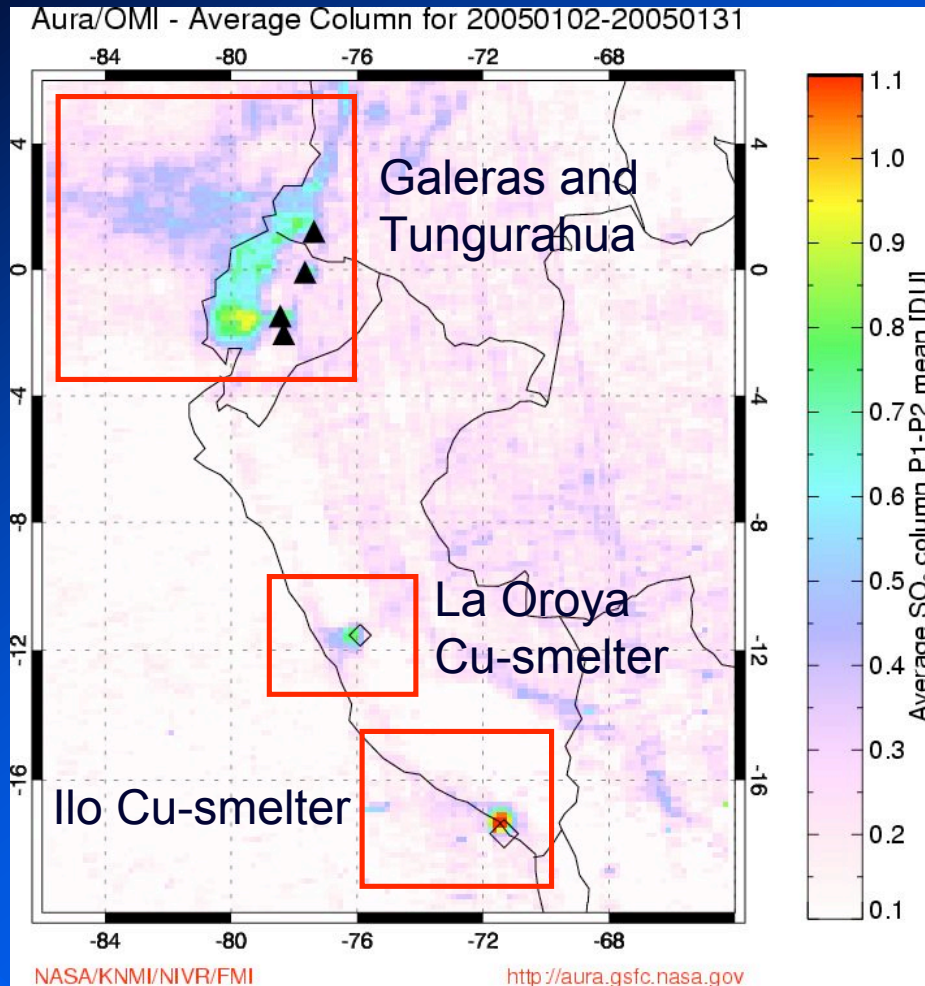


NO₂ - Tropospheric ozone precursor

 Elevated NO₂ regions



OMI SO₂ measurements



Sep 2004

G&T: 1150 td⁻¹

Or: 2150 td⁻¹

Ilo: 4100 td⁻¹

Oct 2004

G&T: 2200 td⁻¹

Or: 2600 td⁻¹

Ilo: 3500 td⁻¹

Nov 2004

G&T: 4550 td⁻¹

Or: 750 td⁻¹

Ilo: 3600 td⁻¹

Dec 2004

G&T: 10850 td⁻¹

Or: 750 td⁻¹

Ilo: 3500 td⁻¹

Jan 2005

G&T: 5300 td⁻¹

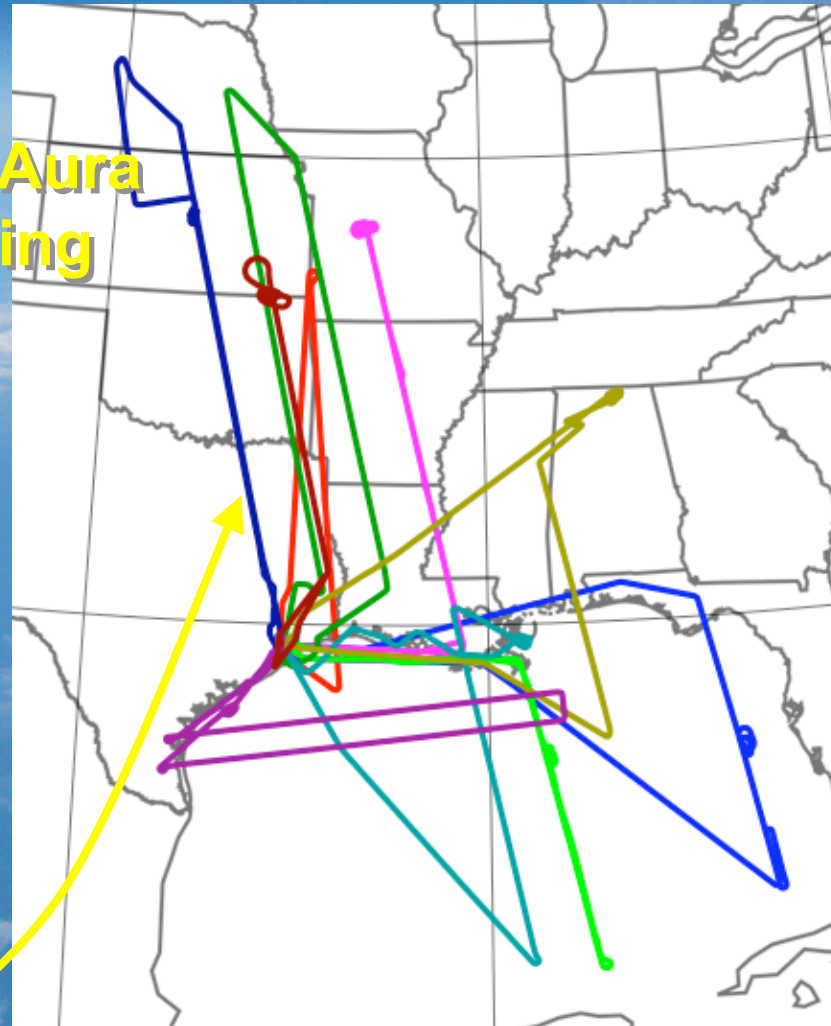
Or: 500 td⁻¹

Ilo: 1250 td⁻¹



WB-57F AVE-Oct. Flight Tracks

- Multiple intercepts of Aura ground track at crossing time
- Extensive along-track sampling and vertical profiling from near surface to 18 km
- Sampling over ocean, land, clouds

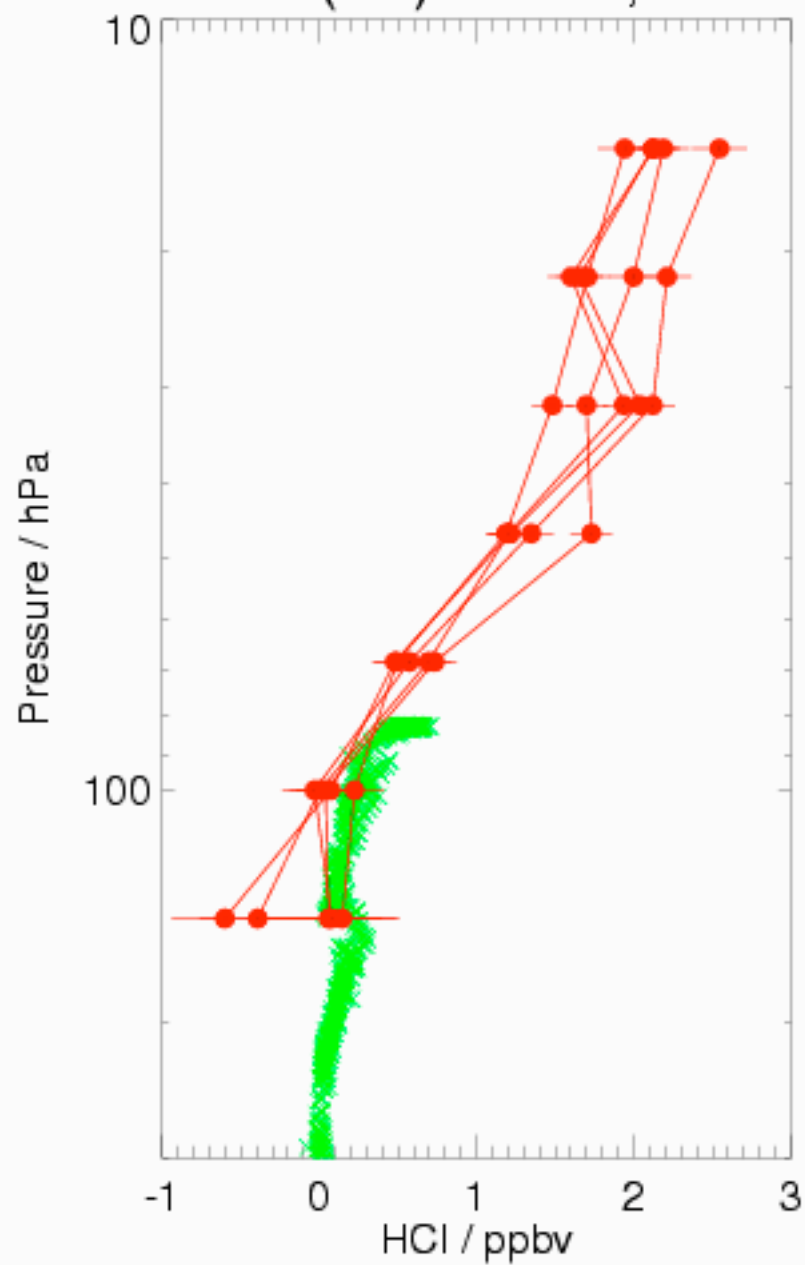


Flights
Oct. 22
Oct. 26
Oct. 29
Oct. 31
Nov. 03
Nov. 05
Nov. 07
Nov. 09
Nov. 10
Nov. 12

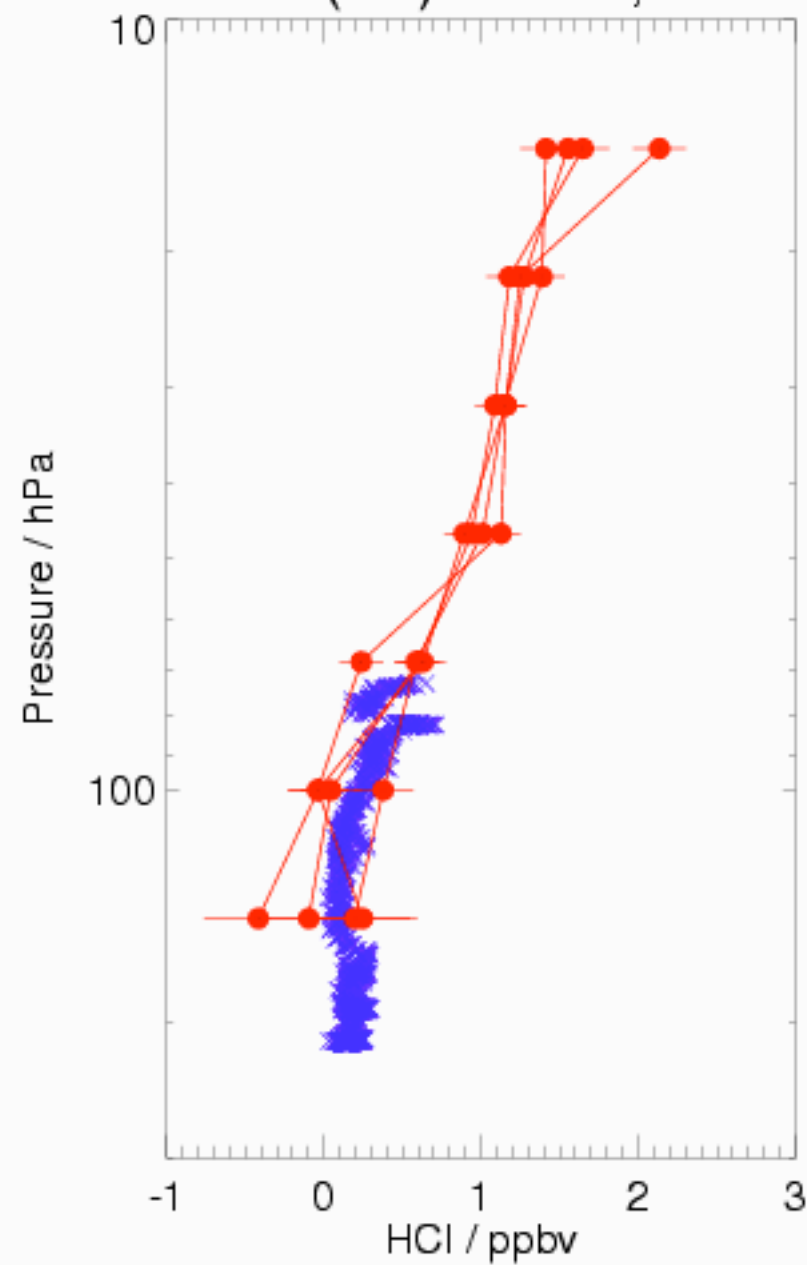
Nov. 3, 2005 - Tropopause fold flight



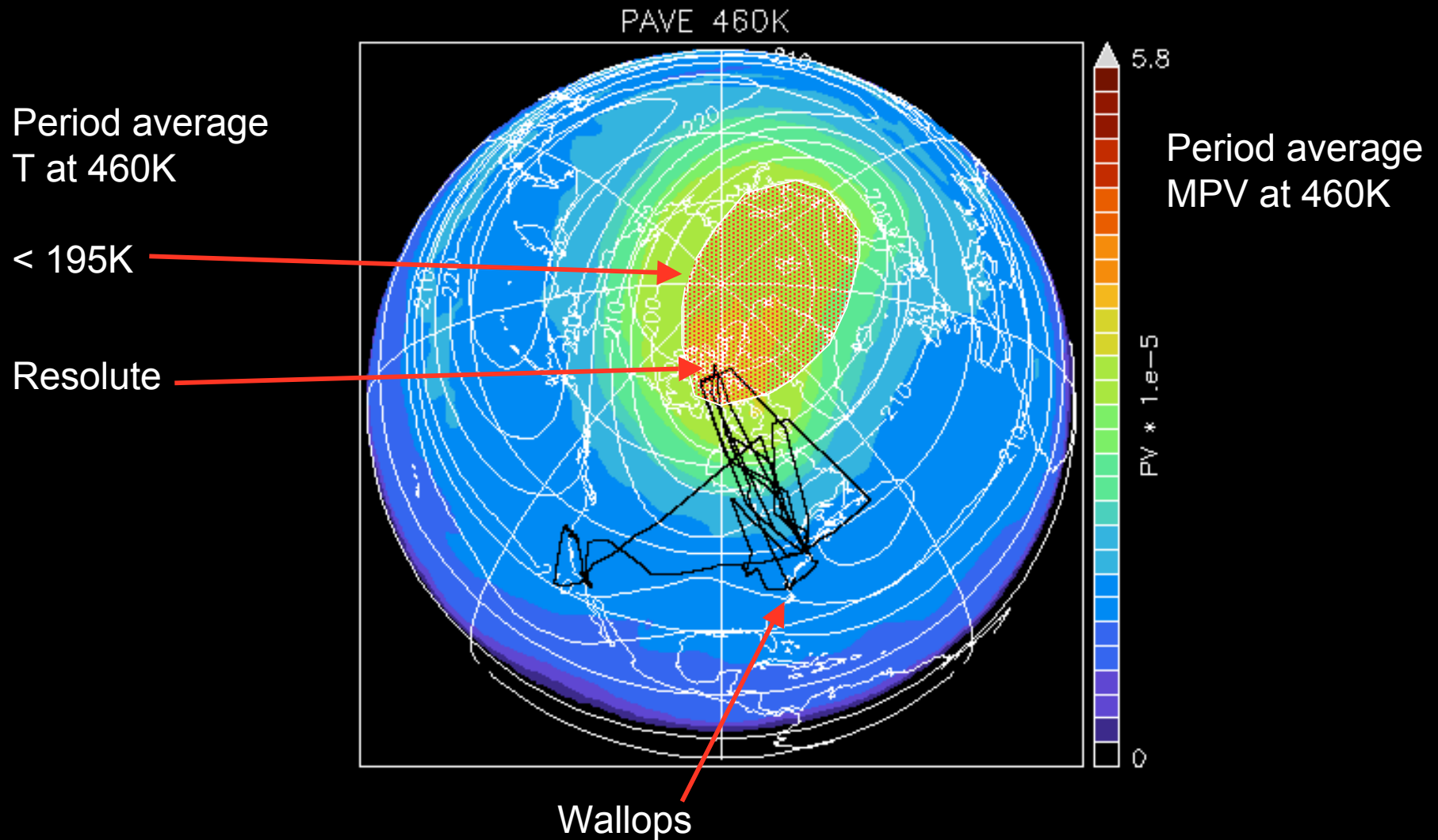
MLS HCl (red) & CIMS, 04/11/05



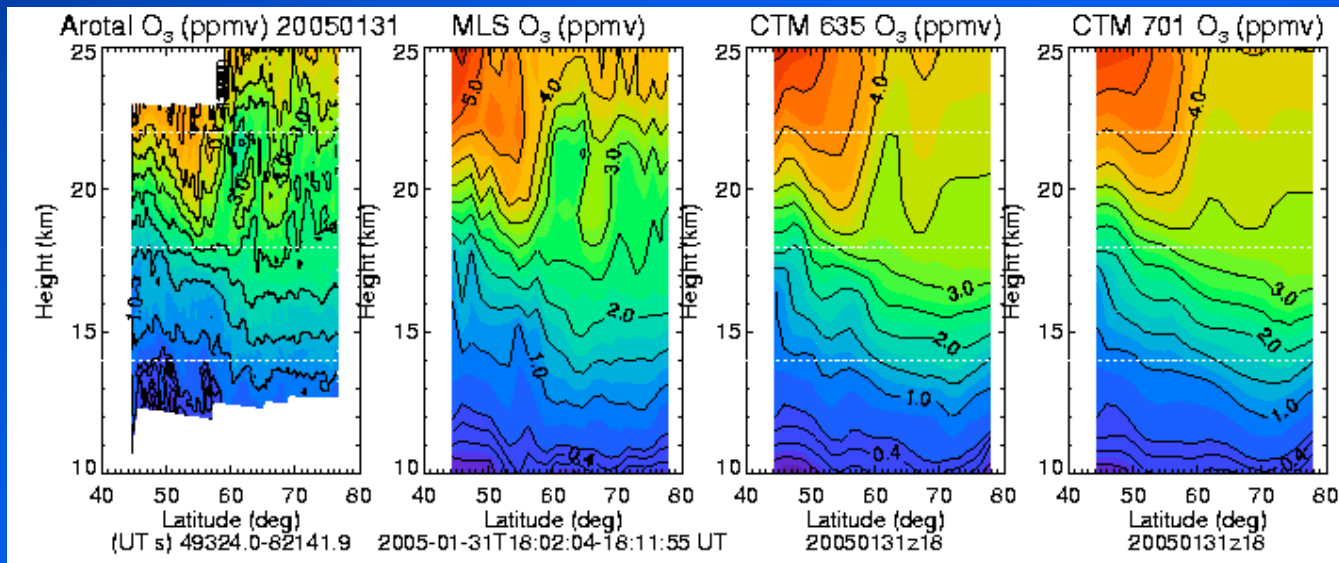
MLS HCl (red) & CIMS, 04/11/05



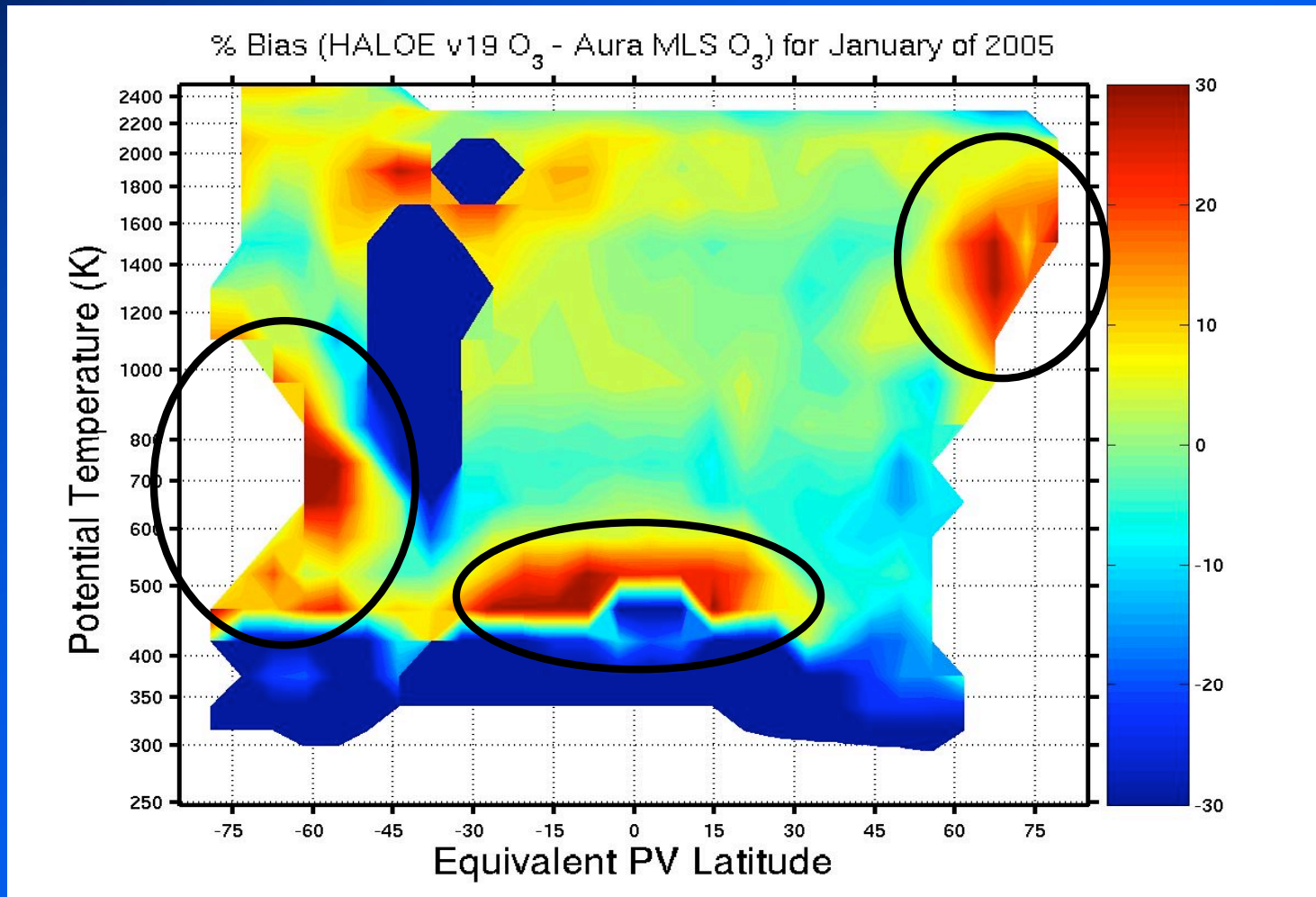
PAVE Flights Jan 20-Feb 9



1/31/05 Ozone Comparisons



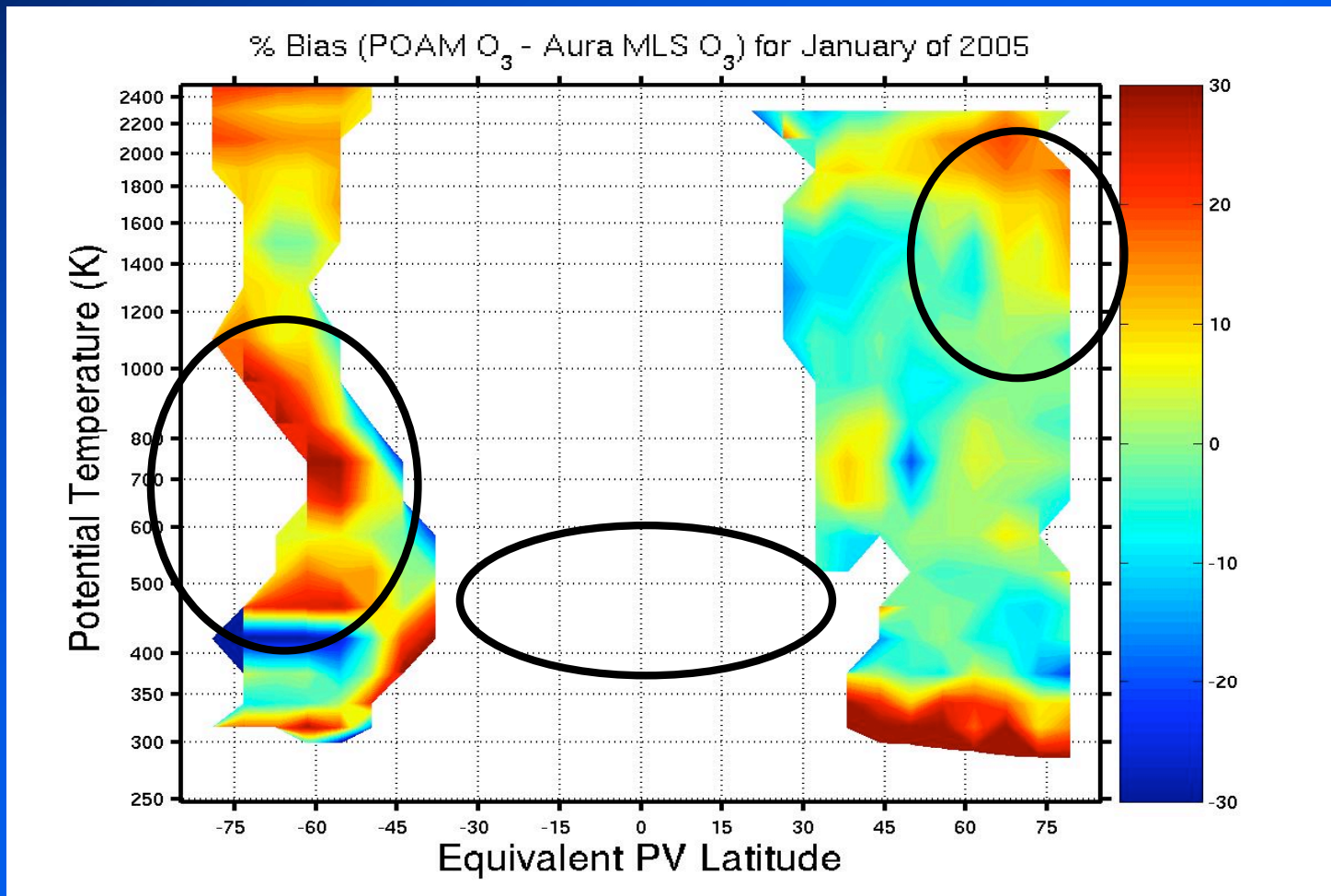
Satellite-satellite Validation



Aura MLS vs HALOE



Satellite-satellite Validation



Aura MLS vs POAM

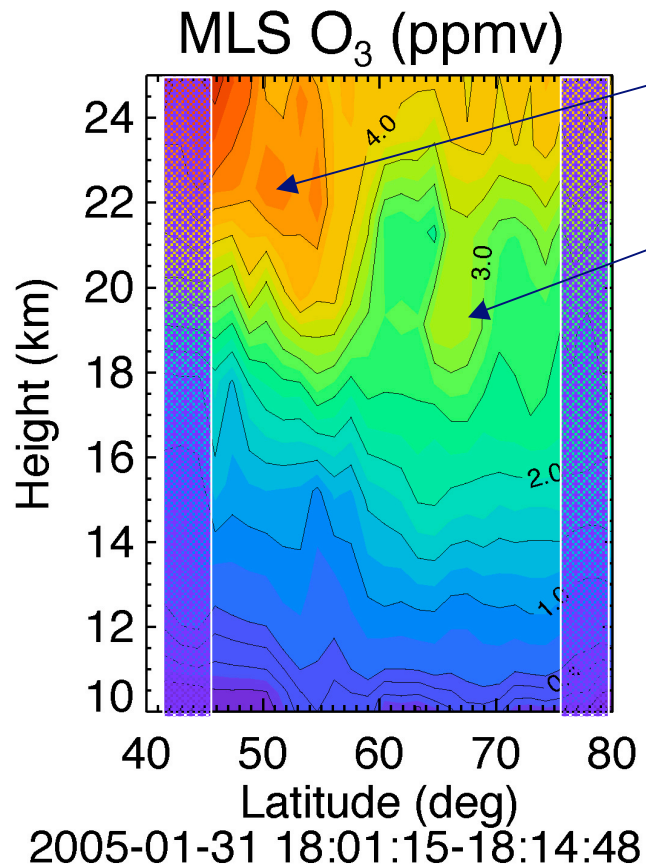
The End

Acknowledgements

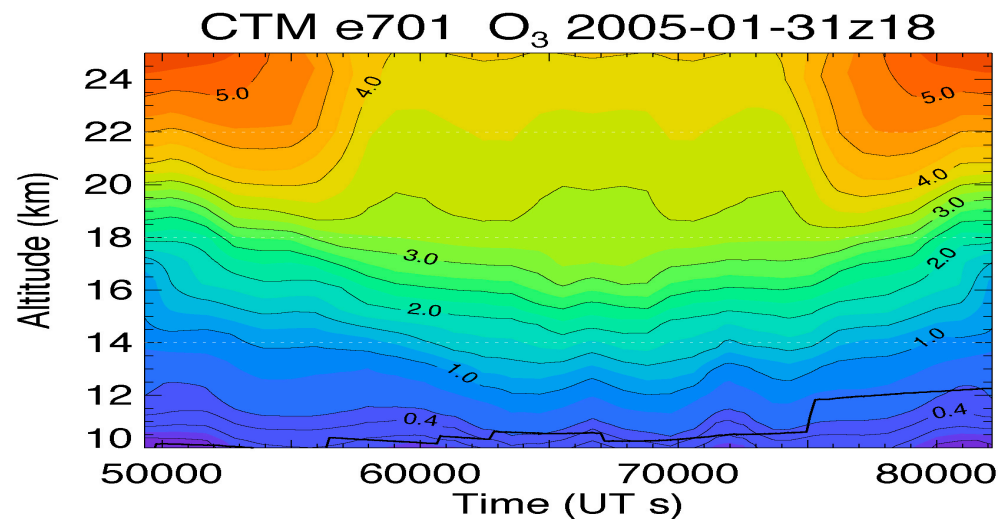
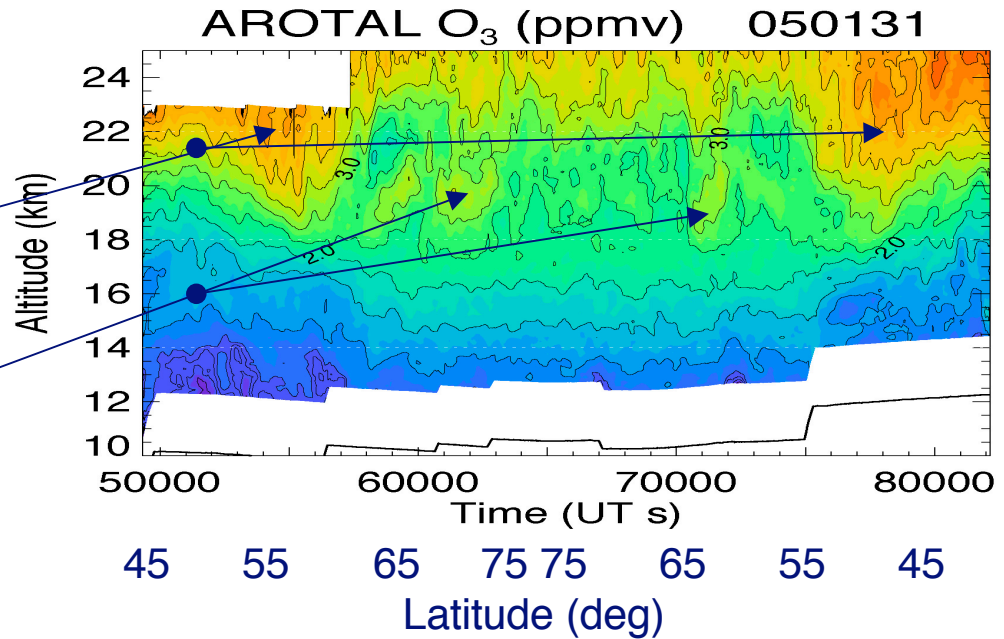
AVE Team
PAVE Team



1/31/05 Ozone Comparisons



Randy Kawa



MLS Water Vapor

Water vapor tropical “Tape Recorder”

- Zonal average deviation from mean
- Summer/wet and Winter/dry cycles

